

Industrial DG

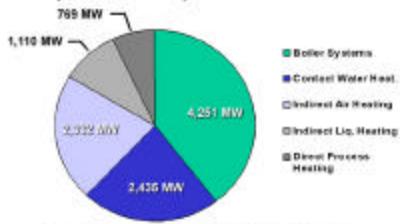
DG Improvements in Industrial Applications

DG Improvements in Industrial Applications Subcontract (4000005689)

Energy Solutions Center (ESC) formerly Industrial Center

- Competitively procured. Project initiated December 2000
- Cost Share = 85% ESC and 15% DOE (\$300,000)
- Phase I: Market assessment projected 11 GW potential in the industrial sector.
- Phase II: 2-5 demonstrations, case studies, "Applications Manual"
- Project end date: early-2003 (unless additional sites are funded)
- Results to be disseminated in form of case studies and Applications Manual to be available on Energy Solutions Center website: energysolutionscenter.org and to be included in *Our Technology Magazine*, which is inserted in Plant Engineering Magazine twice annually, with a paid subscription of 17,000.

Phase I – Market Assessment Revealed Top 5 Industrial CHP Systems Have 11 GW Potential



Source: "Assessment of Replicable Innovative Industrial Cogeneration Applications," Resource Dynamics, June, 2001

Phase I – Market Assessment Identified the Following Barriers

- Product performance and availability*
- Lack of off-the-shelf integrated systems*
- Presence of supporting market infrastructure*
- Accessories, information, and education of end users*
- Demonstration of recent/ongoing studies*
- Environmental regulation
- Planning, zoning, and codes
- Tax treatment
- Utility rate structures
- Interconnection standards

* addressed in Phase II and Conversion Activities

FAITH PLATING DEMONSTRATION

| | |
|---------------|--|
| Site: | Los Angeles, CA |
| Product: | Cleaner plating shop |
| Cost Utility: | Southern California Gas Company |
| Power Gen.: | Four 30 kW Capstone micro-turbines |
| Heat Rec.: | Hot water for plating tank heating |
| Operator: | None installed |
| Status: | Data collection started June 2002. |
| Comments: | Customer interested in using waste heat from the Unifit heater for edge drying for maximum heat recovery – other plating companies interested. |

C & F Packing DEMONSTRATION

| | |
|---------------|--|
| Site: | Lake Villa, IL |
| Product: | Processed meat and sausage |
| Cost Utility: | Natural Gas |
| Power Gen.: | Two 1125 kW Waukesha engines |
| Heat Rec.: | Boiler feedwater preheating from one engine jacket |
| Operator: | 9 am to 10 pm |
| Status: | New facility commissioned May 2002. Power Generation data collection started June 2002. CHP mode started September 2002. |
| Comments: | Rate response drives operation, when used in direct contact steam, potential to expand heat utilization |

DG Improvements in Industrial Applications (cont) Scheduled 2003 Activities

- Prepare case histories
- Complete application manual – Table of Contents:
 - Chapter 1 - Introduction
 - Chapter 2 - CHP Technologies
 - Chapter 3 - Industrial Processes and Applications to Integrate CHP Systems
 - Chapter 4 - Installation and Design Tips
 - Chapter 5 - Evaluating Applications
 - Chapter 6 - Case Histories
- Select and select additional Industrial CHP demonstrations for the five key process applications

DG Operational Reliability and Availability Database Subcontract (4000007241)

Energy Nexus

- Competitively Procured: Project initiated in February 2001
- Cost Share: DOE (\$300,000), GTI (\$30,000 in-kind), NYSERDA (\$30,000), and Industrial Center (\$30,000)
- Establish baseline operating and reliability data for industrial and commercial distributed generation systems
- Identify and classify DG system failures and outages
- Project end date: early-2003
- Results to be made available as follows: DG Reliability database will be user friendly and can be provided to users on CD Rom or via DOE or other website

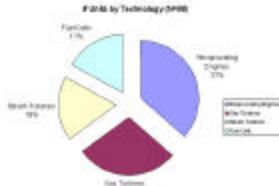
DG Operational Reliability and Availability Database Scope of Completed Work

- Project Accomplishments
 - Reviewed Prior Operational Reliability Work
 - Developed Candidate Screening Process
 - Completed Data Collection and Management Plan and Software
 - Completed DB Structure
 - Completed Post Processing Calculations
 - Data Collection and Analysis on 88 DG and CHP units complete
 - Assessed Reliability and Availability
- Tasks in Scope of Work in Progress
 - Analysis of reliability by prime mover technology groups and duty cycle
 - Failure causes by component/system distribution
 - Final Report & CO

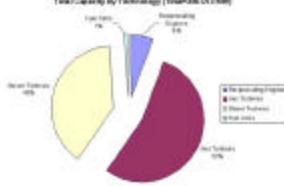
DG Operational Reliability and Availability Database Project Results

- Data collected on 89 sites representing 88 units for 2000-2001 time frame
 - 3330 outage hours
 - 321,000 total hours of operation
- Units specific failure indicator rates (all technology groups) used in higher load conditions than lower load conditions have similar failure rates
- Period based failure rates for standby units are much lower due to the low utilization of those units that provide fewer opportunities for failure to occur
- Entire Sample Results
 - 91.95% Average Availability Factor (9.25 hrs. down)
 - 4.3% Average Prime Operating (7.21 hrs. down)
 - 2.78% Average Standby (1.21 hrs. down)
 - 46.51% Average Service Time (27.45 hrs. down)
- Breakdown by prime mover technology and duty cycle needed before drawing conclusions

Breakdown of 88 Units in Database by Technology Type



Breakdown of 88 Units in Database by Capacity



*Note: This number is about 10% of total estimated capacity in U.S.